Astrobee Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

ANTICIPATED BENEFITS

To NASA funded missions:

Astrobee will be a new free-flying robot for the International Space Station (ISS). Astrobee will support multiple uses: (1) micro-gravity robotics research facility (succeeding the current SPHERES facility), (2) remotely operated mobile sensor platform to perform IVA surveys and to provide mobile camera views, and (3) autonomous mobile inventory using a RFID scanner. The facility capability will enable a broad range of engineers and researchers to test new robotics technology (algorithms, payloads, etc) in microgravity. The sensor platform capability will increase the situation awareness of flight controllers and improve their ability to support the ISS and crew. The mobile inventory capability will save crew time by reducing the time needed to manually search for equipment.

DETAILED DESCRIPTION

Astrobee is a free flying robot for inside the ISS. It will be used by flight controllers for doing mobile sensing and camera tasks. It will replace SPHERES to be used by researchers for 0g robotics testing.

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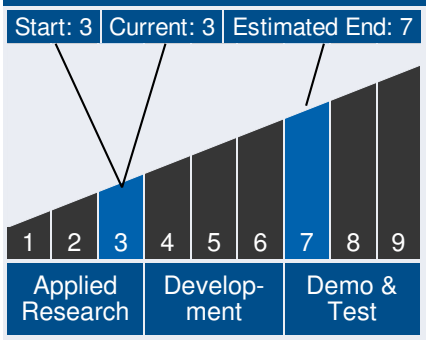
Technology Maturity



Management Team

Program Executive:

- Lanetra Tate

Program Manager:

- Mary Wusk

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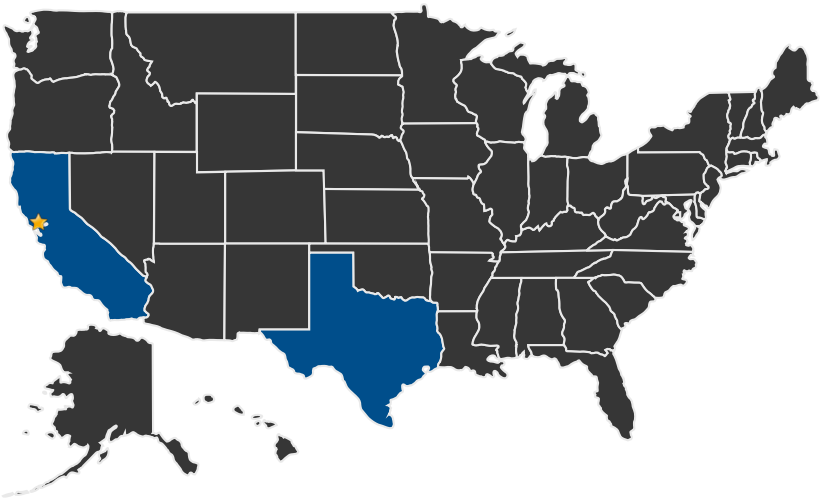
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Ames Research Center

Other Organizations Performing Work:

- Human Exploration and Operations Mission Directorate

Management Team *(cont.)*

Project Manager:

- Terrence Fong

Principal Investigator:

- Robert Ambrose

Technology Areas

Primary Technology Area:
Robotics and Autonomous Systems (TA 4)
- Sensing and Perception (TA 4.1)
  - Object, Event, and Activity Recognition (TA 4.1.4)
    - Natural Object Recognition (TA 4.1.4.1)
- Mobility (TA 4.2)
  - Small-Body and Microgravity Mobility (TA 4.2.4)
    - Free-Floating Robots (TA 4.2.4.1)

Secondary Technology Area:
Robotics and Autonomous Systems (TA 4)
- Human-System Interaction (TA 4.4)
  - Remote Interaction (TA 4.4.8)

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Technology Areas *(cont.)*

- Robotics and Autonomous Systems (TA 4)
  - Sensing and Perception (TA 4.1)
    - Object, Event, and Activity Recognition (TA 4.1.4)
      - Event Recognition (TA 4.1.4.3)
  - Manipulation (TA 4.3)
    - Collaborative Manipulation (TA 4.3.5)
      - Collaborative Manipulation (TA 4.3.5.1)
  - Human-System Interaction (TA 4.4)
    - Proximate Interaction (TA 4.4.3)
      - Robot-to-Suit Interfaces (TA 4.4.3.1)
  - System-Level Autonomy (TA 4.5)
    - Activity Planning, Scheduling, and Execution (TA 4.5.2)
      - Onboard Real-Time Planning and Scheduling (TA 4.5.2.1)
      - Plan/Sequence/Schedule Verification Tools (TA 4.5.2.3)
      - Onboard Executives (TA 4.5.2.4)
      - State Management (TA 4.5.2.5)
  - Systems Engineering (TA 4.7)
    - Safety and Trust (TA 4.7.5)
      - Safety, Trust, and Interfacing Proximity Operation Technologies (TA

Technology Areas *(cont.)*

Human Exploration Destination Systems (TA 7)
- Mission Operations and Safety (TA 7.5)
  - Integrated Flight Operations Systems (TA 7.5.3)
    - Autonomous Crew Operations (TA 7.5.3.1)

Materials, Structures, Mechanical Systems and Manufacturing (TA 12)
- Mechanical Systems (TA 12.3)
  - Electro-Mechanical, Mechanical, and Micromechanisms (TA 12.3.3)
    - Robotic Assembly Tools / Interfaces (TA 12.3.3.1)

DETAILS FOR TECHNOLOGY 1

Technology Title

ISS autonomous free-flying robotic system

Technology Description

This technology is categorized as a hardware system for unmanned spaceflight

Autonomous free-flying robotic system for ISS. This technology includes advancements in vision-based navigation on a mobile free flyer, fan-based propulsion, ISS 3-D path planning, and zero-g robotic perching.

Capabilities Provided

These capabilities will allow the robot to perform autonomous movement, tasks, docking, and resupply.

Potential Applications

Mobile camera views for ISS systems flight controllers (MCC) and payload controllers (POIC). Mobile sound level surveys for the ISS Program. Mobile inventory search for ISS automated logistics. 0g robotic research facility on ISS with minimal crew tending.

Performance Metrics

Metric	Unit	Quantity
Expansion ports	#	4
Consumables per test session	#	0
ISS operating modules	#	8
Maximum velocity	cm/sec	50
Maximum acceleration	cm/sec^2	10
Localize	cm	5
Point	deg	5
Sortie time	hr	8
Dock & resupply	# crew	0